

REMARKS

The Office Action of June 12, 2009, has been carefully studied. Claims 11 and 14-21 currently appear in this application. These claims define novel and unobvious subject matter under Sections 102 and 103 of 35 U.S.C., and therefore should be allowed. Applicant respectfully requests favorable reconsideration and formal allowance of the claims. The herein claimed process can be used on all of the heterocyclic trifluoroalkylene compounds originally claimed.

Previous Claim Objections

Claims 11 and 14-20 are objected for containing both elected and non-elected subject matter.

The present amendment cancels non-elected subject matter from the claims, even though it is respectfully submitted that the process claimed herein should not be limited to the compounds now remaining in the claims.

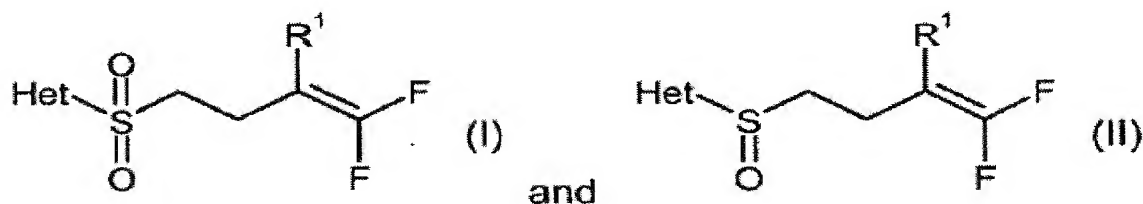
Art Rejections

Claims 11 and 14-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al., WO 01/02378, which corresponds to US 6,731,198, in view of Betterton, *Environ. Sci. Technol*

28(3), 1992, 527-532. The Examiner's position is that Betterton teaches that at neutral pH, the second order rate constant for oxidation of DMS to DMSO₂ is 10 times higher than that of H₂O₂, and in alkaline solution it could be three orders of magnitude higher. The greater reactivity of HSO₅⁻ could therefore make it more attractive than H₂O₂ where rapid reaction is required.

This rejection is respectfully traversed.

Betterton only discusses oxidation of alkyl sulfides by peroxymonosulfate. In contrast thereto, the process claimed herein is for preparing heterocyclic fluoroalkenyl sulfone and sulfoxide compounds of formulas (I) and (II):



As disclosed in the specification as filed at page 2, lines 11-20:

It has now been found that, surprisingly, the use of salts of peroxomonosulfuric acid of the formula H₂SO₅, for example, potassium hydrogenperoxomonosulfate, KHSO₅, as oxidizing agents allows the use of particularly mild conditions. It has been found that, for example, Oxone ® and Caroat® are particularly suitable. It is also to be regarded as surprising that the second step of the oxidization of the sulfoxide to the sulfone, after neutralization of the mixture, proceeds

with just as few problems as the first. **It is to be regarded as unexpected in particular that it was not possible to observe any significant oxidation of the double bond of the trifluorobutenyl radical, which is particularly problematic in existing processes.**
[emphasis added]

In the declaration submitted with the amendment filed April 3, 2009, Dr. Shlomo Cohen reacted heterocyclic sulfide with a salt of peroxomonosulfuric acid, and then reacted the sulfoxide produced with a salt of peroxomonosulfuric acid to produce a sulfone. Dr. Cohen found that in preparing the sulfone from the sulfoxide, in order to complete the reaction, it is critical that the pH of the reaction be above 6, and preferably from 8 to 9. If the pH is below 6, the reaction does not proceed to termination, resulting in poor yield. By maintaining the pH above 6, the reaction proceeds smoothly to termination under moderate conditions, resulting in high yields and purity of sulfone in a short time.

As noted above, the herein claimed process does not oxidize the double bonds of the heterocyclic trifluoroalkenyl sulfone and sulfoxide. Betterton only discloses the mechanism of transformation of reduced sulfur compounds including alkyl sulfides such as dimethyl sulfide and diethyl sulfide. These alkyl sulfides and sulfoxides are completely different compounds from the heterocyclic trifluoroalkenyl sulfides and sulfoxides treated in the presently claimed process. The alkyl sulfides do not have

double bonds that must be protected from oxidation during the process.

There is absolutely nothing in Betterton that even suggests that the oxidation of alkyl sulfides would be analogous to the oxidation of heterocyclic trifluoralkenyl sulfides and sulfoxides.

Moreover, Betterton merely teaches (page 531, second column) that "At neutral pH the second-order rate constant for oxidation of DMS by H_2SO_5^- is nearly 10 times higher than that of H_2O_2 and in alkaline solution it could be 3 orders of magnitude higher." From this, it follows that Betterton teaches that as the pH rises above neutral pH, the reactivity decreases. This also supports the instability of H_2SO_5^- at a higher pH, as discussed in the previous response.

Additionally, Betterton teaches that the greater reactivity of H_2SO_5^- could make it more attractive than H_2O_2 where **rapid reaction** is required [emphasis added].

However, the rapid reaction of H_2SO_5^- as compared to H_2O_2 teaches nothing concerning the preventing of yield loss of the reaction. In this respect, the Examiner's attention is directed to paragraph [0005] of the US publication (page 2, lines 5-11). It should be noted that the rate of the reaction is not necessarily related to the yield of the reaction. Furthermore, the rate of reaction teaches nothing concerning the selectivity of the

reaction. It is self-evident that a high yield of pure reaction product is an important characteristic of a process.

One skilled in the art aware of (i) the structural formula of the starting compound of the herein claimed method, (ii) the Betterton reference and (iii) attempting to prevent yield losses which are caused by undesired reactions, would not have been led by Betterton to favor the use of H_2SO_5^- , since Betterton teaches nothing concerning selectivity and yield of the reaction claimed herein.

It should also be noted that the reaction in Betterton, in which DMS serves as a substrate (starting material), has nothing to do with the process claimed herein in which the starting compound contains a double bond that is sensitive to oxidation reactions. One skilled in the art, being aware of the sensitivity of double bonds to oxidation, would not look to Betterton for reaction conditions for compounds having double bonds.

Therefore, it is respectfully submitted that Betterton teaches nothing concerning the unexpected results of high yield and selectivity achieved by the herein claimed process. It is clear that the presently claimed method brings about remarkable improvement in yield and selectivity, which could not be predicted by any of the prior art.

Double Patenting

Claims 11 and 14-20 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 6 of Watanabe et al., US 6,734,198, in view of Patani et al., *Chem. Rev.* 1996, 3147-3176.

This rejection is respectfully traversed.

Watanabe claims reacting a compound of formula (Ib) with an oxidizing agent, optionally in the presence of an inert solvent. Watanabe says nothing at all about the pH of the reaction condition, which has been claimed in the present process. It has been demonstrated that the pH is critical to termination of the reaction in the herein claimed process.


The Cohen declaration makes it clear that the pH is critical to the success of the reaction. Patani adds nothing to Watanabe, because Patani merely relates to the steric properties of substituting hydrogen for fluorine, and has nothing to do with oxidizing sulfides, and even less with conducting oxidation at a pH of from 6 to 10.

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Amd. dated December 11, 2009
Reply to Office Action of June 12, 2009

In view of the above, it is respectfully submitted that the claims are now in condition for allowance, and favorable action thereon is earnestly solicited.

Respectfully submitted,

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